

**August 2024 Vol.4(8),** **2738-2741**





**Popular Article**

Climate Change, Global Warming and Livestock Production

**Dr. Prajna Mohapatra**

Assistant Professor, Department of Animal Nutrition, Institute of Veterinary Science and Animal Husbandry, Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha.

**Introduction**

From the time immortal, climate is in a state of continuous change. But during the past century, some natural causes like volcanic eruptions, solar variations, and fluctuation in orbital sequences of the earth and manmade causes like air pollution and greenhouse gas emissions have been the major contributors to climate change and increasing global temperature. According to the Intergovernmental Panel on Climate Change (IPCC, 2013), a body of the United Nations, global climate change is primarily caused by greenhouse gas emissions that result in the warming of the atmosphere. The greenhouse gases capture the infrared rays reradiated from the surface of the earth, causing an increase in the temperature of the troposphere layer of the atmosphere and subsequently, Global Warming.

**Greenhouse Gases (GHGs)**

Among the major greenhouse gases Carbon dioxide (CO2), Methane (CH4), Nitrous oxide (N2O), Chlorofluorocarbons (CFCs) and Ozone (O3) are most important. Large amount of carbon dioxide is emitted by the burning of fossil fuels, industry, transportation, agriculture etc. Considering the sources of methane emission, the major sources are the production of natural gases, oil, livestock and other agricultural practices. Similarly, Nitrous Oxide emission occurs during the combustion of fossil fuels, agricultural use, land use, industrial activities and wastewater treatment. Another important GHG is chlorofluorocarbons, which are emitted from different types of household and industrial uses like refrigerants in air conditioners, aerosol propellants etc. Ozone is the fifth most important greenhouse gas frequently emitted from the combustion of fossil fuels, vehicles, evaporation of paints etc.

**Impact of Livestock Production on Climate Change**

Among all the greenhouse gases, major sources of methane and Nitrous Oxide are from livestock and other agricultural practices.Livestock contributes 14.5% of total anthropogenic emissions of greenhouse gases (Gerber et al., 2013). The FAO Global Livestock Environmental Assessment Model (GLEAM) results that, the contributions of livestock towards GHG emissions are; 50 % Methane (CH4), 24 % Nitrous Oxide (N2O), 26 % Carbon Dioxide (CO2). Among the different sources of greenhouse gases, livestock shares about 9% of total carbon dioxide emissions, 37% of total methane gas production and 65% of nitrous oxide. Regarding species, cattle are the major contributor to total livestock emissions (62%).

**Sources of Livestock and Livestock Farm Related Greenhouse Gases**

The meat and dairy animals contribute to the greatest food-generated Greenhouse Gas(GHG) emissions. Direct animal emissions occur through enteric fermentation by the rumen microorganisms, faeces, and urine excretion (Sejian et al., 2015). Indirect emissions are from the feed crops, manure application, CO2 emitted during fertilizer application, processing and transportation of livestock products, fossil- fuels use in farm activities like heating/ cooling animals, ventilation, illumination, machine milking, and post-harvest emissions. Some other important sources are deforestation, land desertification due to livestock grazing, and cultivated soils.

**Impacts of Climate Change on Livestock Production**

Climate change and global warming have bi-directional impacts on livestock production; direct and indirect. The major direct effect of climate change on animals is ‘Heat Stress’. It subsequently causes a reduction in feed intake, and increased water requirement, ultimately leading to decreased performance. The body weight and average daily weight gain are reduced and the body condition of livestock is declined. In dairy animals, milk yield is reduced and milk quality is affected. The reproductive performance is lowered, and immune function is decreased. The animal becomes more susceptible to various diseases and the mortality rate is high. The indirect impact is related to the feed and fodders as the supply of forages is reduced, and the nutritive value of the forages is reduced which may lead to higher methane production. Water availability decreases as temperature rises, but the water requirement of the animals increases.

**Mitigation Strategies to Reduce Emission of Greenhouse Gases from Livestock Animals**

The metabolism of nitrogen within the rumen produces hydrogen. This hydrogen is syphoned out through the formation of methane by the rumen methanogens. Methanogens are the microorganisms present within the rumen. They are mostly the anaerobic Archaea. Hence the major strategies should aim to reduce the production of hydrogen, inhibit methanogenesis, redirect hydrogen into alternative products and provide alternative sinks for hydrogen. Some nutritional strategies can be followed to achieve these goals.

**Nutritional Strategies**

**Diet Quality:** The diet should contain a high proportion of concentrates as the roughages containing more cellulose and hemicellulose, ferment faster than starch and sugar, yielding more methane So, concentrates should be preferred.

**Forage Species**: Legume forages emit less methane and hence can be preferred over grasses.

**Feed Supplements:** Lipids like fat and oil (lauric acid and myristic acid) are toxic to methanogens and may be used as feed supplements. They can be added @ 6-7% in the diet.

**Feed Additives:**

Organic acids (e.g. Fumaric acid) can act as an alternative sink for hydrogen. Two important alternative sinks for hydrogen are propionate production and reductive acetogenesis. So, the amount of hydrogen required for methane formation is reduced.

Ionophores (e.g. Monensin) are antimicrobial. Monensin affects the electrolyte transport across the cell walls of the methanogens and other bacteria. It does not affect the propionate-producing bacteria population, which is essential for rumen fermentation. Thus, it decreases methane production. More propionic acid is produced in the rumen with decreased acetic acid formation, causing a reduction in methane production.

**Grazing management:** Forage or feed crop production is one of the most important GHG emitters. Hence, animals grazing on pasture are attributed to reduced GHG emissions. Some common grazing management practices are; grazing livestock at a stocking rate according to the land's carrying capacity, rotational grazing, and grassland enclosure.

**Manure management:** Livestock manure generates nitrous oxide and methane. Proper handling of manure can control the emissions. Long-term storage with high temperatures causes higher GHG emissions. Hence, a regime of shortened storage periods with low storage temperatures should be followed.

**Fertilizer Management:** Precision application of fertilizers, use of organic fertilizers, and genetic modifications of feed and fodder crops are some strategies that can be followed.

Apart from these nutritional strategies, other management strategies like; proper genetic selection and breeding of the animals, and housing according to the climatic conditions are necessary to alleviate the emission of greenhouse gases from livestock and livestock-related farm activities contributing to global warming and improve the health and production efficiency of livestock animals despite the harsh effects of climate change.

**Conclusion**

We should stop blaming the voiceless innocent animals as the major contributors towards the Greenhouse gas emission. Rather we should strictly follow mitigation strategies like organic farming, application of organic fertilizers, proper grazing management, genetic modifications of feed and fodder crops, use of feed supplements and feed additives in the diet of the animals to reduce methane emissions.

**References**

IPCC. Intergovernmental Panel on Climate Change. 2013. Climate change 2013: The physical science basis. In: Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Xia, Y., Bex, V., Midgley, P.M. (Eds.), Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 1535.

GLEAM. Global Livestock Environmental Assessment Model. Food and Agriculture Organization of the United Nations (FAO). <https://www.fao.org/gleam/results/en/>.

FAO. Food and Agriculture Organization of the United Nations. Livestock and Landscapes: Sustainability Pathways. Food and Agriculture Organizations of the United Nations. <https://www.fao.org/3/ar591e/ar591e.pdf>.

Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A., Tempio, G. 2013. Tackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities. https://www. cabdirect.org/cabdirect/abstract/20133417883.

Sejian Veerasamy, Iqbal Hyder, T. Ezeji, J. Lakritz, Raghavendra Bhatta, J.P. Ravindra, Cadaba S. Prasad, and Rattan Lal. 2015. Climate Change Impact on Livestock: Adaptation and Mitigation, 141 DOI 10.1007/978-81-322-2265-1\_10.

Top of Form